SPAN-SE Receiver

QUICK START GUIDE

GM-14915082 Rev 3 May/2012

This guide provides the basic information you need to set up and begin using your SPAN-SE receiver.

BOX CONTENTS

In addition to this *Quick Start Guide*, the following is provided in your SPAN-SE package:

- **1** SPAN-SE receiver
- **2** multi-connector cables
- **1** mounting bracket with screws
- **1** 6-foot USB 2.0 cable
- **1** industrial SD memory card
- **1** power cable
- **1** multi I/O connector cover
- **1** CD containing PC Utilities and product documentation
- **1** patent notice and manual request postcard

ADDITIONAL EQUIPMENT REQUIRED

The following additional equipment is needed for a basic setup:

- A Windows®-based computer with an RS-232 DB9, USB or Ethernet port
- A power supply that produces 12 – 28 volts DC
- A quality dual frequency GNSS antenna such as the GPS-702, the GPS-702-GG, the ANT-A72GA-TW-N for airborne/high speed applications, or the GPS-702L antenna for L-Band corrections
- A TNC to appropriate antenna connector RF cable
- A SPAN-supported IMU such as NovAtel numbers: IMU-H58, IMU-H62, IMU-H00, IMU-LN200, IMU-FSAS-EI, IMU-FSAS-EI-O, IMU-CPT, UIMU-LCI, IMU-HG1900 or IMU-HG1930

INSTALLING NOVATEL PC UTILITIES

Before setting up your SPAN-SE system, install NovAtel's *PC Utilities* on the Windows-based computer that you will use to communicate with it.

1. Start the computer.
2. Insert the accompanying CD in the CD-ROM drive.

> To access and download the most current version of our OEMV PC Utilities, go to the Support page of the NovAtel web site at www.novatel.com.

3. Select *Install the OEMV PC Utilities* from the window that is automatically displayed. If the window does not automatically open when the CD is inserted, select *Run* from the *Start* menu and select the *Browse* button to locate *Setup.exe* on the CD drive.
4. Install the PC Utilities by advancing through the steps provided in the *NovAtel GPS PC Utilities* setup program.

SPAN HARDWARE SET-UP

Complete the following steps to set up and power your SPAN-SE.

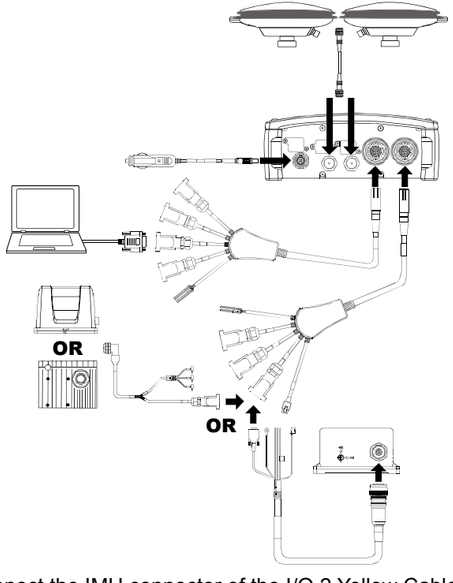
1. Mount the IMU and antenna securely to a vehicle. Ensure that the devices cannot move and that the distance and relative direction between them is fixed.
2. Connect the 30-pin connector of the I/O 2 Yellow Cable to the yellow port labelled I/O 2 on the SPAN-SE. The cable clicks when connected properly.
3. Connect the GNSS antenna to the port labelled GPS1 on the receiver using an appropriate antenna cable.
4. Connect a communications cable from your computer to the SPAN-SE.

   If you want to connect via a serial connection, connect the COM1 connector of the I/O 2 Yellow Cable to a computer using a straight-through serial cable.

   If you want to connect via USB, connect a USB cable from the computer to the USB Device port on the SPAN-SE.

   If you want to connect via Ethernet, connect a shielded network cable from the computer to the Ethernet port on the SPAN-SE.

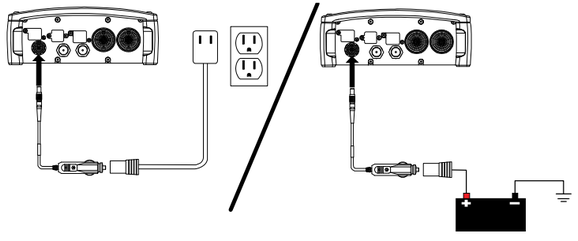
   See the *SPAN-SE User Manual* for information on communication connection options.



5. Connect the IMU connector of the I/O 2 Yellow Cable to an IMU with the IMU interface cable.
6. Insert the SD card into the slot behind the front panel door.

> Files stored on the SD card can be transferred to a host computer for data analysis or other types of post-processing by using the FTP functionality built into the SPAN-SE or by removing the SD card and inserting it into a host computer that has an SD card slot or an adapter attached.

7. Apply power to the receiver. Do not press the power button; the receiver powers up automatically. If possible, add a back-up battery between the receiver and its voltage supply if installed in a vehicle. The backup battery acts as a buffer to prevent power dips that can cause the receiver and IMU to lose lock and calibration settings.



8. Connect additional serial communications equipment as needed. The following ports are available:
   - 4 UART serial (RS-232/RS-422 configurable)
   - 1 USB
   - 1 Ethernet

Refer to the *SPAN-SE User Manual* for detailed information on configuring the SPAN-SE communication ports.

LED STATUS INDICATORS

There are six LEDs on the front of the SPAN-SE receiver that represent the following status categories:

- Power
- SD card memory
- Internal OEMV-3 card status (GPS 1)
- Internal OEMV-2 card status (GPS 2)
- INS filter
- IMU communication

The following table details the states of each LED, which remain solid unless the table indicates a flashing condition.

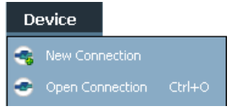
Table 1: SPAN-SE LEDs

LED	Off	Green	Orange	Red
Power	No power to the unit	Powered and the unit is off Flashing: powered and the unit is on	N/A	N/A
SD	No card	Card in Flashing: file open	Card in, low space Flashing: file open	Card in, full
OEMV3	No board	Solution complete + fine steering Flashing: coarse steering	Insufficient observations	Receiver status error (bits: 0,1,2, 7)
OEMV2	No board	Solution complete and fine steering Flashing: coarse steering	Insufficient observations	Receiver status error (bits: 0,1,2, 7)
INS	GPS only	Solution good Flashing: alignment complete	Aligning Flashing: solution bad	INS inactive
IMU	No IMU	Good RAWIMU packets	No RAWIMU (IMU type not set)	IMU status error bits

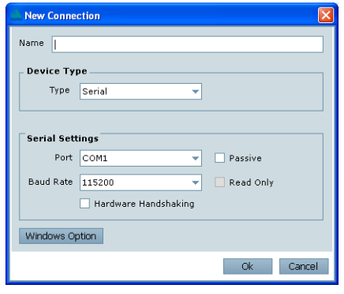
ESTABLISHING RECEIVER COMMUNICATION

To open a serial port to communicate with the receiver, complete the following:

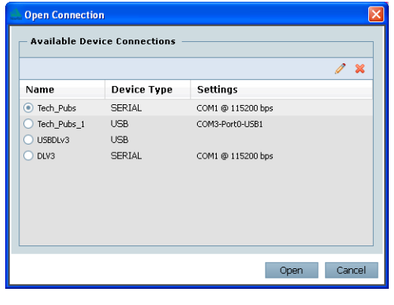
1. Launch **Connect** from the *Start* menu folder specified during the installation process. The default location is *Start* | *All Programs* | *NovAtel PC Software* | *NovAtel Connect*.
2. Select *New* from the *Device* menu.



3. Enter a name for the Connection setup.



4. Select *Serial* from the *Type* list.
5. Select the computer port that the SPAN-SE is connected to from the *Port* list.
6. Select *115200* from the *Baud Rate* list.
7. Ensure the *Hardware Handshaking* check box is cleared.
8. Click the *OK* button to save the new device settings.
9. From the *Device* menu, select *Open Connection*.

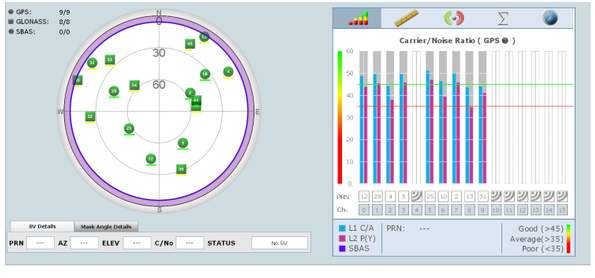


10. Select the new configuration from the *Available Device Connections* area of the *Open Connection* dialog and click the Open button.

    Connect establishes a communication session with the receiver and displays the progress. Once connected, the progress box disappears and several windows open, including the Console window. **Connect** is now ready for use to view status information, enter commands or log data.

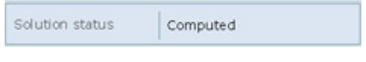
Using Connect

Connect provides access to key information about your receiver and its position. The information is displayed in windows accessed from the *View* menu. For example, select *Position Window* from the *View* menu to display the position solution of the receiver. To show details of the GNSS and geostationary (SBAS) satellites being tracked, select the *Tracking Status Window* from the *View* menu. Select *Help* from the main menu for more details on Connect, its windows and features.



Determining When the Position is Valid

When the receiver has a valid position, the *Solution Status* field in the Connect *Position* window shows Computed:



Entering Commands

The SPAN-SE uses a comprehensive command interface. Commands can be sent to the receiver using the *Console* window in Connect, which is opened from the *View* menu. Enter commands in the text box at the bottom of the Console window.

The OEMV Family Quick Reference Guide, available on the CD or on our Web site, provides comprehensive information about available commands. The SPAN-SE User Manual provides information on a subset of these commands; in particular, the ones commonly used with the SPAN-SE.

SAVECONFIG Command

If you change the configuration of a function and want to save the new settings for your next session, use the SAVECONFIG command.

When using NovAtel Connect to configure your receiver, ensure all of the graphical windows are closed before you issue the SAVECONFIG command.

CONFIGURING GNSS

Depending on the accuracy of the solution required, GNSS can be augmented with a number of correction sources including SBAS, L-Band and RTK (RTCA, RTCM, RTCM V3 and CMR). Refer to the *SPAN-SE User Manual* for SBAS, L-Band or RTK setup and operation.

Enabling Real-Time Kinematic (RTK) Positioning

Corrections can be transmitted from a base station to a rover station to improve position accuracy. The base station is the GNSS receiver that acts as the stationary reference. It has a known position and transmits correction messages to the rover station. The rover station is the GNSS receiver that does not know its exact position and can receive correction messages from a base station to calculate differential GNSS positions.

You must create a data link between the base station and rover station (two NovAtel receivers) to transfer corrections. SBAS and L-band corrections can be accomplished with one receiver and are exceptions to the base/rover concept. A link capable of at least 9600 bits per second and less than 4.0 seconds of latency is recommended. When connecting a base station to a SPAN-SE, the data link must connect to the SPAN-SE OEMV3 COM port, found on the I/O 1 Green Cable.

When the base and rover stations are set up, you can configure them for RTCA, RTCM, RTCMV3, CMR+ or CMR corrections. Below is an RTCM example. Replace the latitude, longitude and height coordinates shown with those of your base:

Base

```
interfacemode com2 none rtcm off
fix position 51.11358042 -114.04358013 1059.4105
log com2 rtcm3 ontime 10
log com2 rtcm22 ontime 10 1
log com2 rtcm1819 ontime 1
log com2 rtcm1 ontime 5
log com2 rtcm31 ontime 5,1
(optional GLONASS PSRDIFF)
log com2 rtcm32 ontime 10,2
```

Rover

```
gnsscardconfig rtcm none off
```

RT-2 and RT-20-capable SPAN-SE receivers with AdVance RTK are real-time kinematic products developed by NovAtel. Optimal RTK performance requires both the base and rovers be NovAtel products. However, AdVance RTK operates with equipment from other manufacturers when using RTCM messaging.

RT-2 and RT-20 are supported by GPS+GLONASS and GPS-only OEMV-based models. Also, RT-20 with GPS+GLONASS provides faster convergence.

1.Refer to the GPGST log's usage box in the *OEMV Firmware Reference Manual* for a definition of RMS and other statistics.

2.For more base/rover configurations, search for "rover base" on our Knowledge Database at: http://support.novatel.com/home.

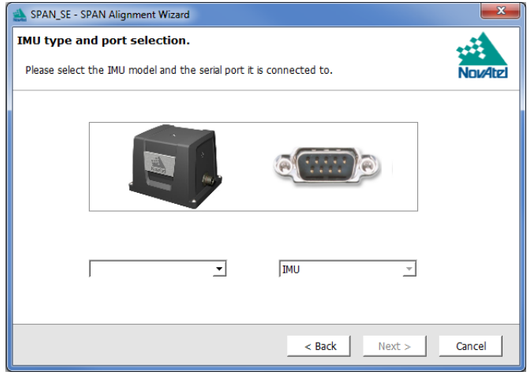
CONFIGURING THE SPAN IMU

Configure SPAN with Connect

Follow these steps to enable INS as part of the SPAN system using the NovAtel Connect software utility:

1. Select *Wizards* | *SPAN Alignment* from the **Connect** toolbar. This wizard takes you through the steps to complete a coarse or fast alignment, select the type of IMU and configure the receiver to IMU port to accept IMU data.

When you have made your selections in the SPAN wizard, click the *OK* button to enable the SPAN system. When the system is enabled, raw IMU data becomes available and the INS filter starts.



Configure SPAN Manually

Follow these steps to enable INS as part of the SPAN system using software commands:

1. Issue the SETIMUTYPE command to specify the IMU.

Table 2: Enable INS Commands

IMU Type	SETIMUTYPE
LN-200	IMU_LN200
iIMU-FSAS	IMU_IMAR_FSAS
IMU-CPT	IMU_KVH_COTS
UIMU-LCI	IMU_LITEF_LCI
IMU-HG1700	IMU_HG1700_AG11, *or* IMU_HG1700_AG17, *or* IMU_HG1700_AG58, *or* IMU_HG1700_AG62
IMU-HG1900	IMU_HG1900_CA29
IMU-HG1930	IMU_HG1930_AA99

The inertial filter starts when the GNSS solution is solved and the IMU is connected.

A GNSS antenna must be connected and actively tracking satellites for correct operation.

2. Use the `SETIMUTOANTOFFSET` command to set the distance from the IMU to the GNSS antenna. The offset between the antenna phase centre and the IMU axes must remain constant and be accurate (m). The X (pitch), Y (roll) and Z (azimuth) directions are clearly marked on the IMU enclosure. The `SETIMUTOANTOFFSET` parameters are (where the standard deviation fields are optional):

```
x_offset y_offset z_offset [x_stdev] [y_stdev] [z_stdev]
```

A typical RTK GNSS solution is accurate to within a few centimeters. For the integrated INS/GNSS system to have this level of accuracy, the offset must be measured to within a millimetre. Any bias between the two systems appears in the output position. For example, a 10 cm error in recording this offset will result in at least a 10 cm error in the output.

If you cannot measure the IMU to GNSS antenna offset precisely, perform the lever arm calibration routine to estimate offset. Refer to the *SPAN-SE User Manual* for details.

Configuration for Alignment

A coarse alignment routine requires the vehicle to remain stationary for at least 1 minute. If that is not possible, an alternate fast alignment routine is available. The fast or moving alignment is performed by estimating the attitude from the GPS velocity vector and injecting it into the SPAN filter as the initial system attitude.

A static coarse alignment is not available for the IMU-CPT or IMU-HG1930 IMUs. The fast, or kinematic alignment must be used instead. A stationary alignment is only possible with a dual antenna SPAN-SE-D, or if the SETINITAZIMUTH or SETINITATTITUDE commands are issued. See the *SPAN-SE User Manual* for more information.

If your have a dual antenna system (SPAN-SE-D), the default alignment mode is a dual antenna alignment. Once you enter the primary and secondary antenna offsets (with SETIMUTOANTOFFSET and SETIMUTOANTOFFSET2 respectively) the system will automatically align as soon as it computes a dual antenna solution. See the *SPAN-SE User Manual* for more information.

LOGGING DATA

You can collect data logs through any I/O port on the SPAN-SE receiver into any data capture software, including **Connect**.

SPAN-SE also has a SD card for data collection. To send data to the SD card, open a file, then use FILE as the port designator in log requests. You must close the file when collection is complete.

For example:

```
LOGFILE OPEN TEST.GPS
LOG FILE RANGECMPB ONTIME 1
LOGFILE CLOSE
```

The SPAN-SE has a default logging profile with all raw data needed for post-processing. If you press the SD logging button, this profile automatically logs to a uniquely named file until the SD logging button is pressed again. To change the default logging profile, send the log requests that you want, the command: SETAUTOLOGGING ON and then SAVECONFIG. The newly-defined profile is automatically logged to the SD card on power up.

Save logs and commands with the `SAVECONFIG` command to ensure that the same logging configuration starts whenever the receiver is powered on. Remove the SD card from the receiver and plug it into a computer to download data from the card. The data logging button, located beside the SD card, stops and starts the data logging if you must change cards during operation.

You can monitor the logs' output to determine the system status. Multiple Connect windows show the status of various receiver subsystems. Light Emitting Diodes (LEDs) on the front of the SPAN-SE receiver also show the status of many subsystems.

Log SPAN Data

Raw GNSS, IMU and navigation data (position, velocity and attitude) are available from the system as ASCII or binary logs.

Data can be collected through Connect using the *Logging Control* window, or sent through the receiver COM port to user-supplied data collection software.

For post-processing applications, collect the data shown in the *Post-Processing* section of this guide.

OPERATING THE SPAN SYSTEM

Observe the status of the system in the Connect *INS* window or in the status field of any of the INS solution logs (for example `INSPOS`, `INSVEL`, `INSATT` and `INSPVA`).

> INS data is available when the GNSS solution has solved for time (i.e., FINESTEERING status). An antenna must be connected and tracking satellites for the system to function.

If performing a static alignment, allow the system to be stationary for at least one minute after the GNSS solution is computed for its initial system alignment.

If performing a kinematic alignment, move the vehicle forward at a speed faster than 1.15 m/s.

If performing a dual antenna alignment, allow the system to begin alignment, and wait approximately thirty seconds for a dual antenna solution to be computed.

The following status stages may be observed:

- The status changes from INS_INACTIVE to INS_ALIGNING when the alignment starts
- The status changes to INS_ALIGNMENT_COMPLETE when the alignment is complete. Typically, this state continues until the system senses motion.
  After some motion (stops, starts, and turns), the attitude solution converges to within specifications, and the status changes to INS_SOLUTION_GOOD.

The status may occasionally change to INS_BAD_GPS_AGREEMENT. This status indicates that the inertial solution has detected poor quality GNSS positions from the receiver due to limited satellite visibility or high multipath conditions. The inertial filter may choose to disregard this information and wait for the GNSS quality to improve. The solution is still valid during this status, but it is a warning that the GNSS/INS solution is more reliable than the GNSS-only solution.

POST-PROCESSING

Post-processing requires collection of simultaneous data from the base and rover stations. This includes accurate coordinates of the base station and accurate measurement of the IMU to antenna separation.

The following logs are required for post-processing:

- From the base station
  - `RANGECMPB ontime 1`
  - `RAWEPHEMB onchanged`
- From the rover station(s)
  - `RANGECMPB ontime 1`
  - `RAWEPHEMB onchanged`
  - `RAWIMUSB onnew`

In addition, the following is required to log GLONASS:

- `GLOEPHEMERISB onchanged`
- `GLOCLOCKB onchanged`

The SPAN-SE system output is compatible with post-processing software from the Waypoint Products Group, NovAtel Inc. Visit their web page at www.novatel.com/products/waypoint-software for more details.

QUESTIONS OR COMMENTS

If you have any questions or comments regarding your SPAN-SE system, please contact NovAtel Customer Service by:

Email: support@novatel.ca
Web: www.novatel.com
Phone: 1-800-NOVATEL (U.S. & Canada)
1-800-668-2835
1-403-295-4900 (International)
Fax: 1-403-295-4901